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SUBJECT:	<b>Engineering Drawing/Graphical Communication</b>
PAPER NUMBER:	I
DATE:	4 <sup>th</sup> October 2021
TIME:	4:00 p.m. to 7:05 p.m.

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### **Directions to Candidates**

Write your index number where indicated at the top of all drawing sheets.

Attempt any **FIVE** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

- drawings should conform to B.S. or equivalent (ISO) standards;
- all dimensions are in millimetres;
- all answers are to be accurately drawn with instruments;
- all construction lines must be left in each solution;
- drawing aids may be used.

Dimensions not given should be estimated.

Careful layout and presentation are important.

Marks will be awarded for accuracy, clarity and appropriateness of constructions.

Question 1.

An illustration of a hexagonal prism interpenetrating an octagonal pyramid is given in Figure 1a. Incomplete orthographic views of the sheet metal prism and pyramid are given in Figure 1b.

You are requested to:

- a. copy the given views; (2)
- b. project an auxiliary plan to be able to plot the resulting intersection in the front elevation; (4)
- c. complete the front elevation; (4)
- d. complete the plan (show hidden detail); (4)
- e. construct the surface development of the octagonal pyramid showing clearly the hole resulting from the intersection. (6)

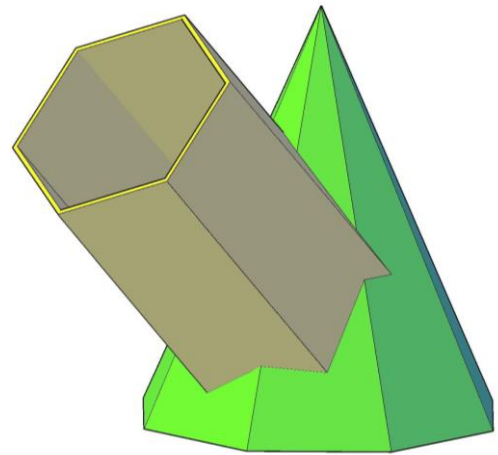


Figure 1a

**(Total: 20 marks)**

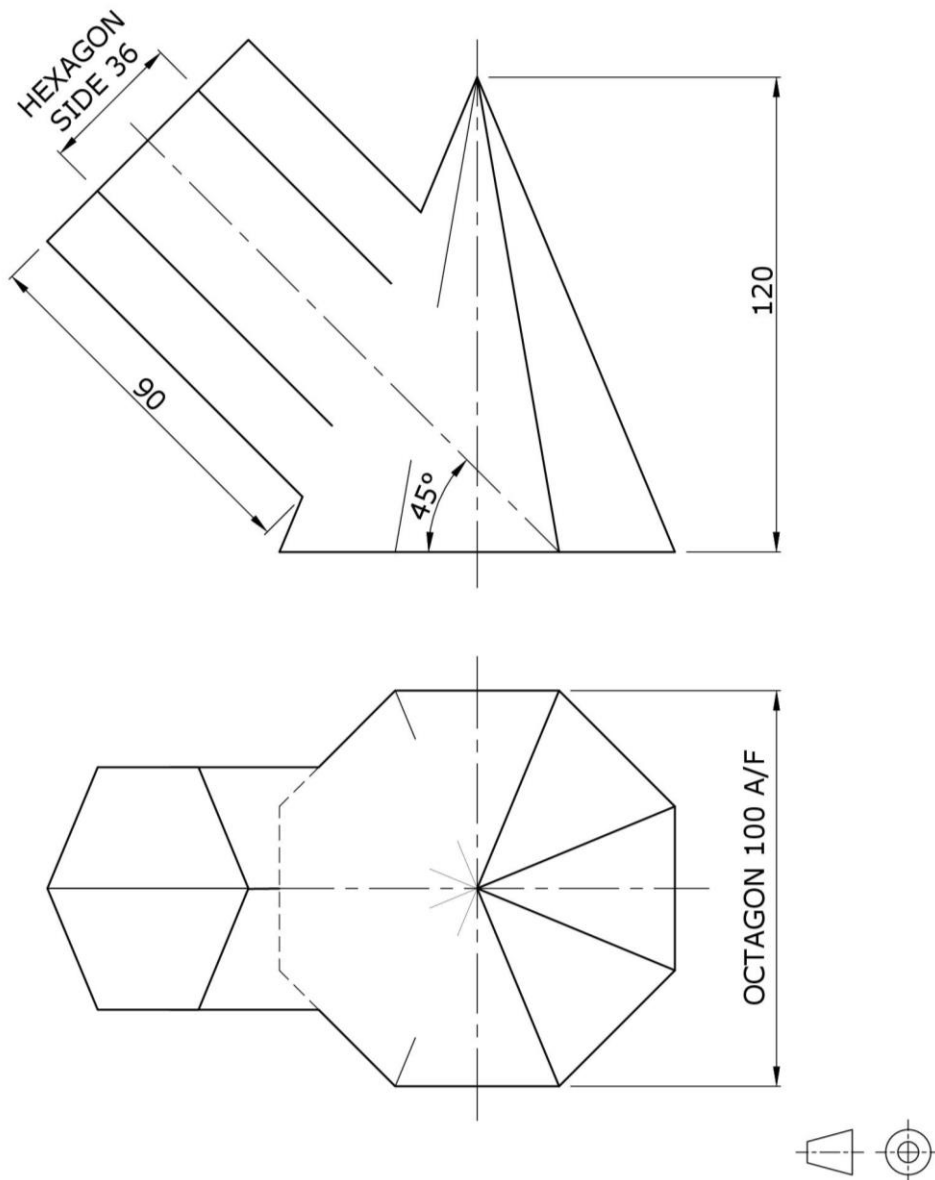


Figure 1b

Question 2.

The illustration in Figure 2a shows a plastic injection moulded part of a lipstick case. Scaled up dimensions of the custom designed, quick action threaded component are given in Figure 2b.

The following data describes the thread:

Profile of thread: square

Number of turns: one and a half

Number of starts: two-start

Thread orientation: right-hand

Pitch: 120 mm

Lead: 240 mm

Inside diameter: 100 mm

Outside diameter: 140 mm

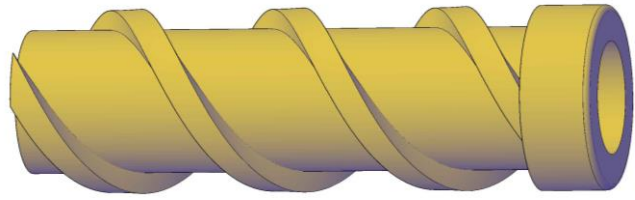


Figure 2a

You are requested to:

a. copy the drawing given in Figure 2b;

(3)

b. construct the helices;

(15)

c. lightly shade **ONE** of the threads.

(2)

Note: Leave all constructions visible.

**(Total: 20 marks)**

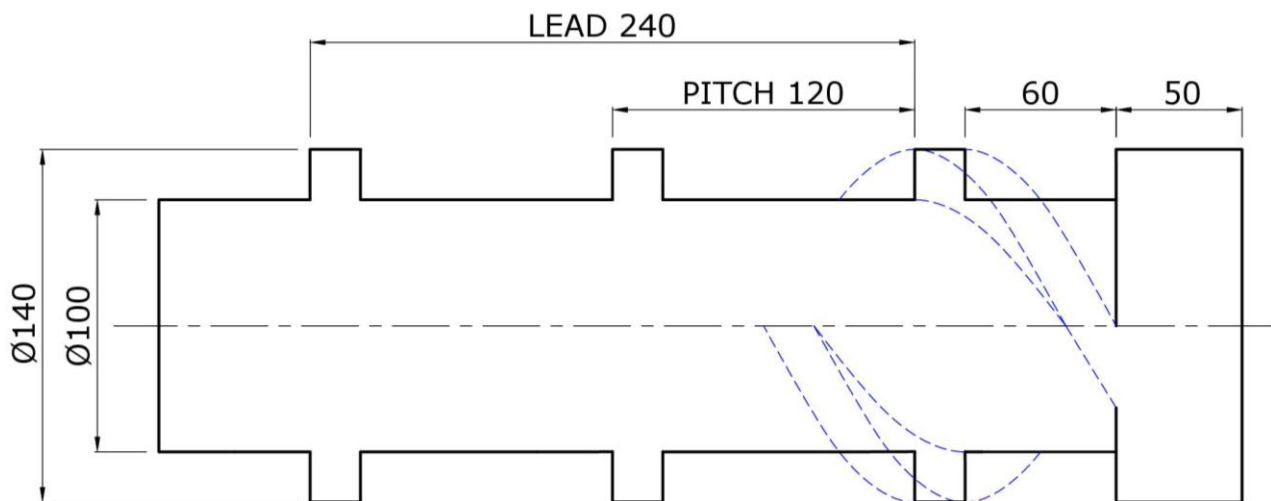


Figure 2b

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Question 3.

A 3-D illustration of a cone, a sphere and a hemi-sphere resting on the horizontal plane is shown in Figure 3a. Two dimensional orthographic views of the cone are given in Figure 3b.

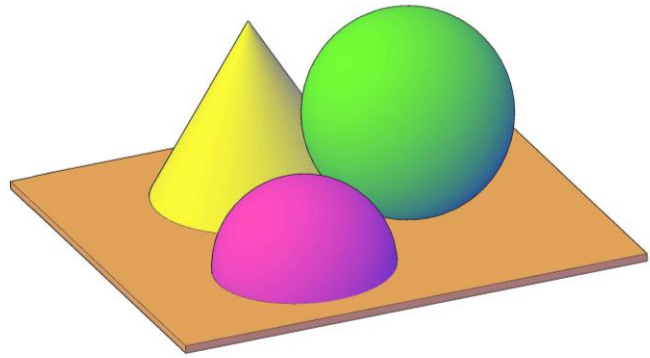


Figure 3a

- The sphere is to be placed on the horizontal plane and touching the cone at contact point 'P'.
- The hemi-sphere SØ84 is to be placed with its flat face resting on the horizontal plane and in mutual contact with both the cone and with the sphere.

You are requested to:

- |   |     |
|---|-----|
| a. copy the given orthographic views;                                   | (2) |
| b. determine, by construction, the diameter of the sphere;              | (4) |
| c. locate the sphere in the plan and the front elevation;               | (4) |
| d. determine, by construction, the position of hemi-sphere in the plan; | (4) |
| e. project the hemi-sphere to the front elevation;                      | (3) |
| f. locate and indicate the points of contacts.                          | (3) |

Notes:

- An auxiliary view is recommended.
- Leave all constructions visible.
- Show hidden detail.

**(Total: 20 marks)**

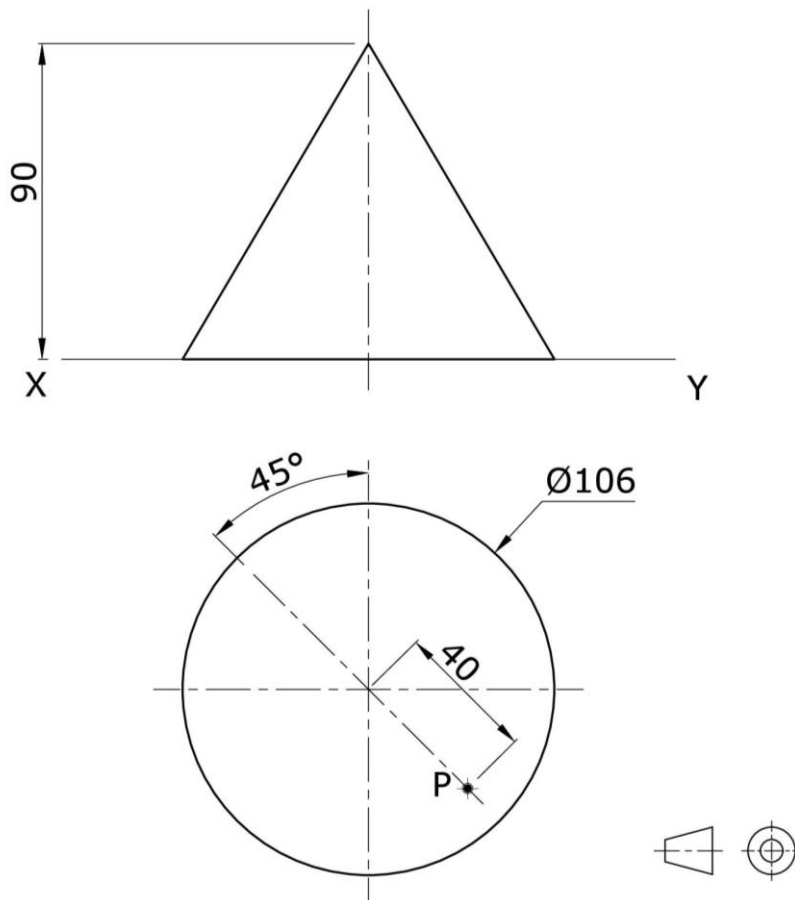


Figure 3b

Question 4.

An illustration of a machined component is shown in Figure 4a. Two orthographic views of the component are given in Figure 4b.

You are requested to:

- copy the views given in Figure 4b; (2)
- project an auxiliary elevation from the direction of arrow **A** to show an edge view of slope **F**; (8)
- project a second auxiliary view of the whole component to show the true shape of face **F**; (8)
- measure geometrically and state the area of face **F**. (2)

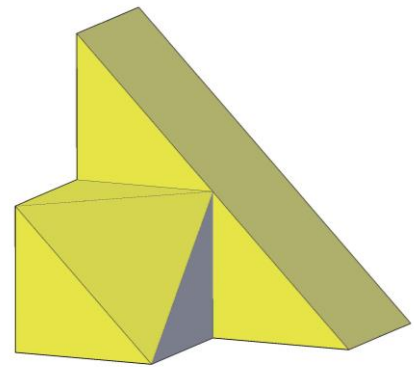


Figure 4a

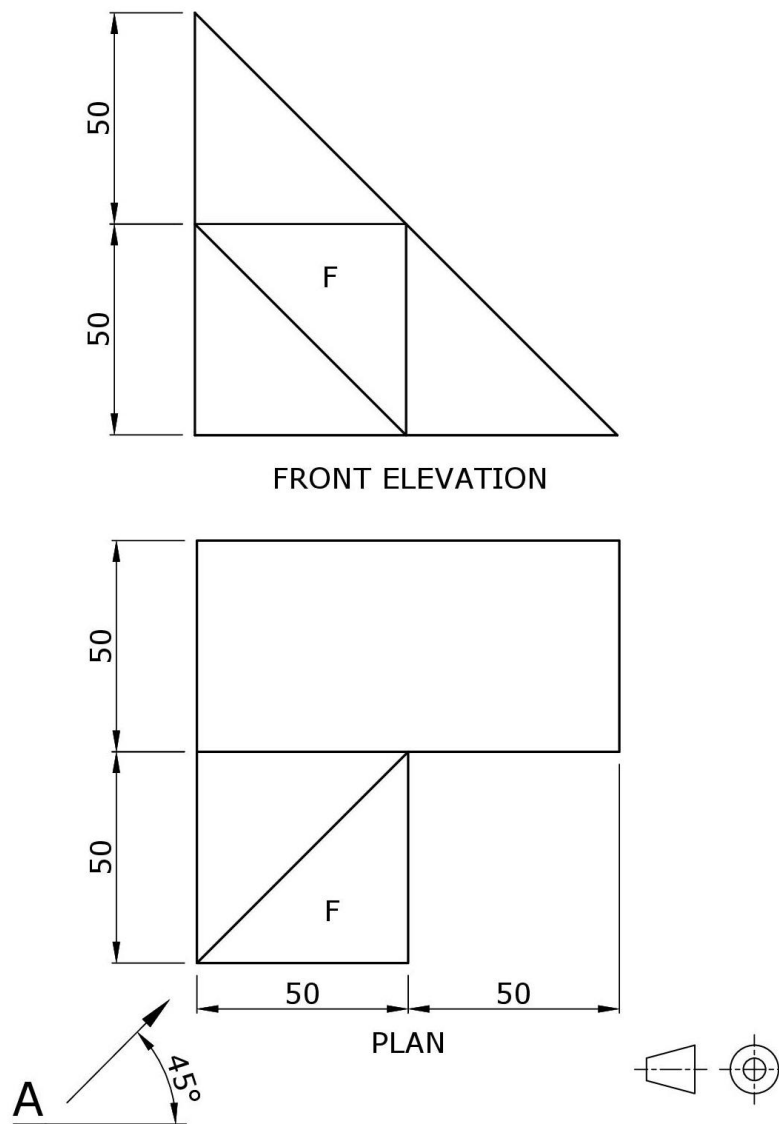


Figure 4b

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Question 5.

A logo of an environment friendly company is illustrated in Figure 5a. The profile of the leaf is produced by means of a  $\text{Ø}60$  generating circle, rolling without slipping, outside the given directing shape. The symmetrical directing profile consists of arcs and straight lines as shown in Figure 5b.



Figure 5a

- Point P, on the circumference of the  $\text{Ø}60$  circle, generates a curve as it rotates clockwise for one revolution, outside the R80 directing arc AB.
- The circle continues to roll for half a revolution on the straight-line BC.
- The circle swings on corner C and continues to roll downwards on straight-line CD.
- Finally, the circle rolls for one revolution on arc DE.

You are requested to:

- copy the drawing shown in Figure 5b; (2)
- plot the locus of P as the circle rolls on arc AB; (6)
- plot the locus of P as the circle continues to roll on straight-line BC; (4)
- plot the locus of P as it swings on corner C; (1)
- write the technical names of the three generated curves; (3)
- reflect the curves CD and DE. (4)

Note: Do **not** draw the stem.

**(Total 20 marks)**

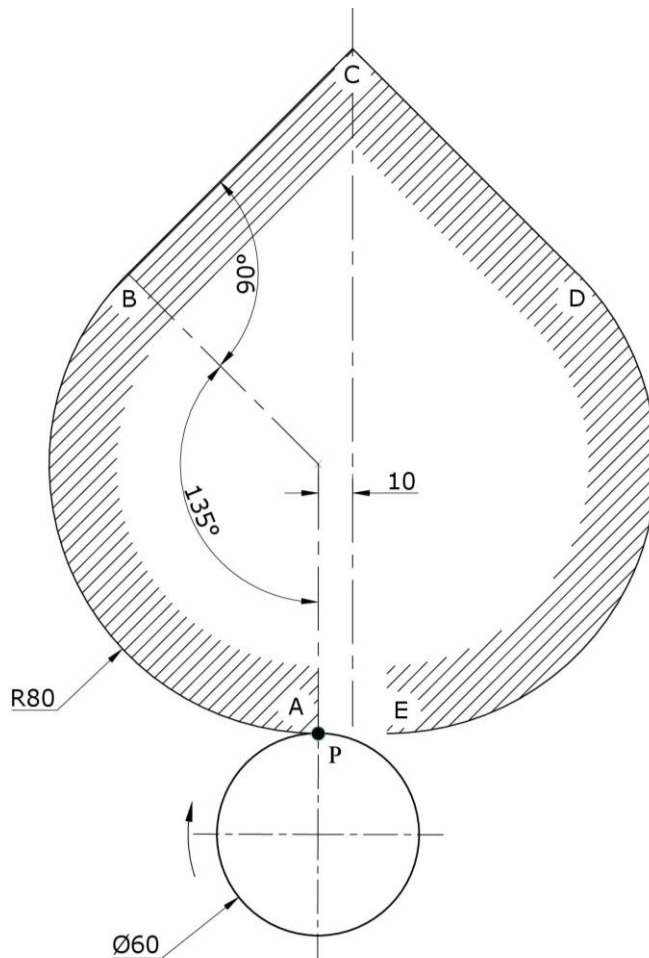


Figure 5b

Question 6.

Three orthographic views of a machined component are given in Figure 6.

You are requested to:

- a. copy the given views; (8)
- b. draw an isometric view of the component. (12)

Note:

- Place corner X in the lowermost position.
- Isometric scale is **not** required.
- Do **not** show hidden detail.

**(Total: 20 marks)**

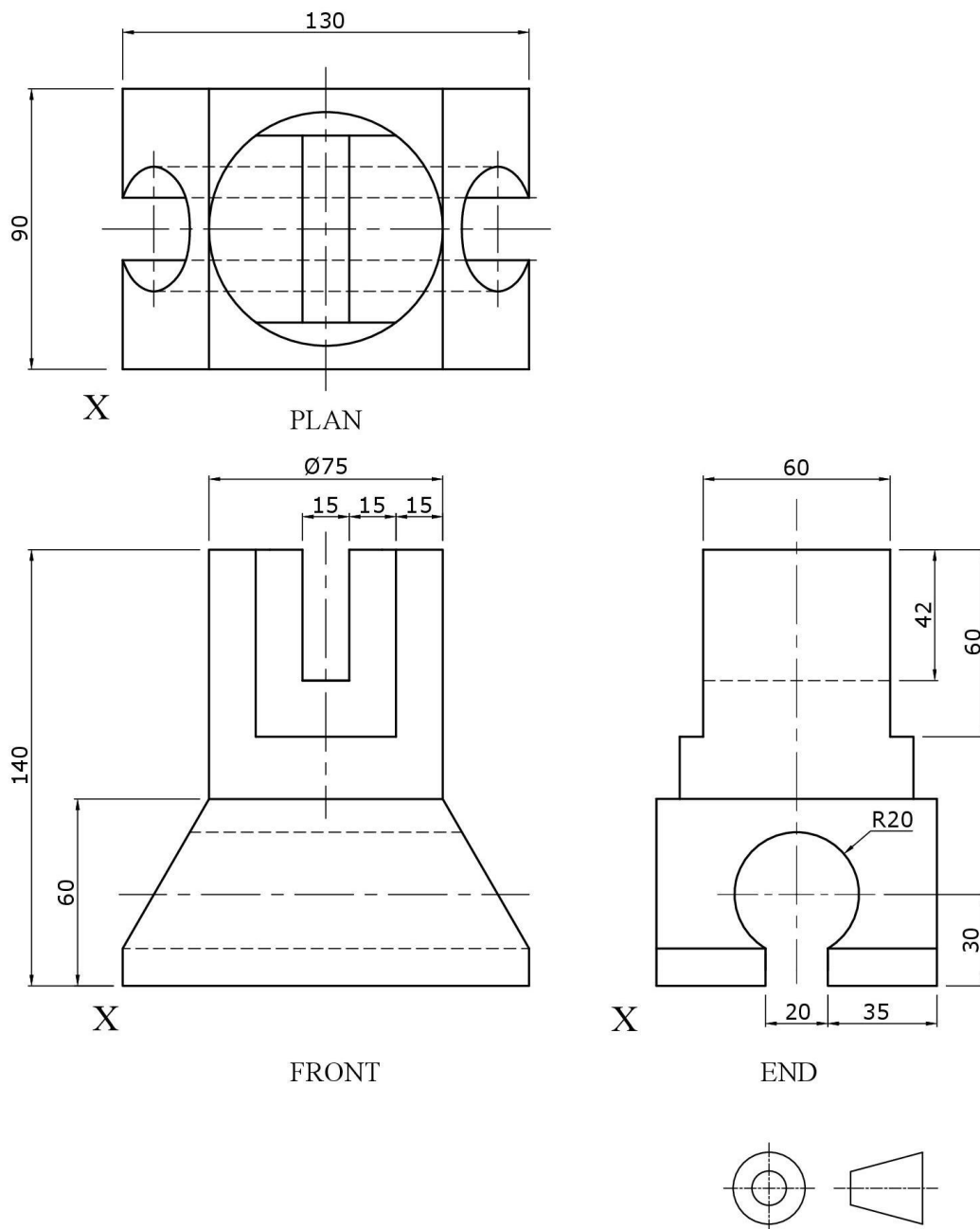


Figure 6

Question 7.

Figure 7a shows an illustration of a drilled octagonal prism being truncated by an oblique plane. Dimensioned orthographic views and details of the traces are given in Figure 7b. The part of the prism above the oblique plane is to be removed.

You are requested to:

- copy the views given in Figure 7b; (2)
- project an auxiliary view of the drilled prism and determine the true angle that the oblique plane makes with the horizontal plane; (5)
- complete the plan of the truncated drilled prism; (1)
- complete the front elevation; (5)
- draw a planometric view of the truncated drilled prism placing corner 'C' in the lowermost position. (7)

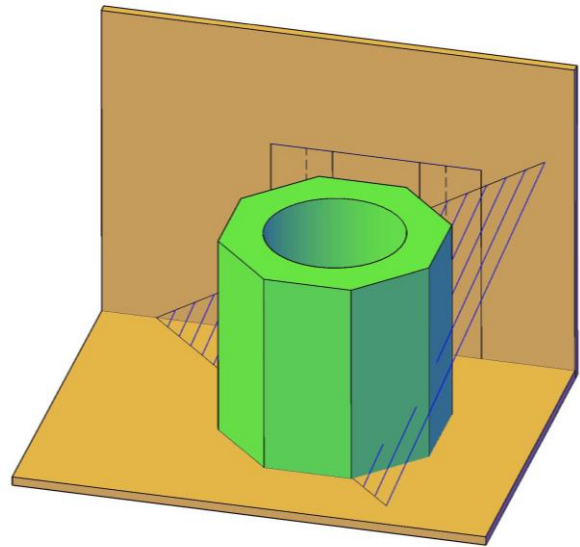


Figure 7a

**(Total: 20 marks)**

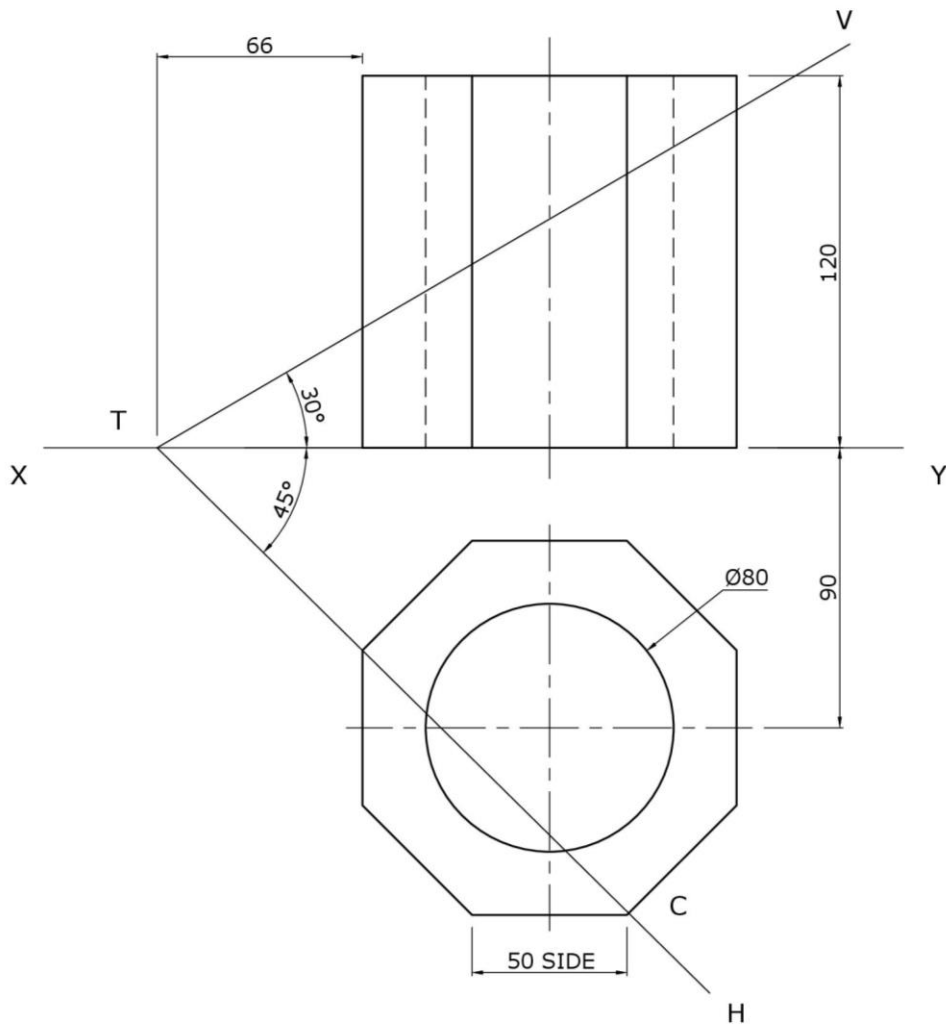
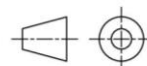


Figure 7b





Question 8.

A uniform cross-section beam is simply supported at  $R_L$  and  $R_R$ . The beam is subjected to a concentrated load of 40 kN at the right end as shown in Figure 8. The weight of the beam is shown as a uniformly distributed load of 15 kN/m.

You are requested to:

- a. copy the beam given in Figure 8 using a linear scale of 10 mm representing 1 m: (1)
- b. break up the U.D.L.; (1)
- c. use Bow's notation to describe the system; (1)
- d. draw the load line using a force scale of 15 mm representing 30 kN; (3)
- e. construct a polar diagram with a polar distance of 100 mm; (3)
- f. construct the bending moment diagram; (3)
- g. construct the shear force diagram; (3)
- h. from the data and diagrams drawn, determine graphically and state:
  - i. the magnitude of the support reactions at  $R_L$  and  $R_R$ ; (2)
  - ii. the position of where the bending moment is zero; (1)
  - iii. the bending moment scale used for 1 mm of ordinate; (1)
  - iv. the position and magnitude of the greatest bending moment. (1)

Note:

A neat and clear notation system must be presented.

**(Total: 20 marks)**

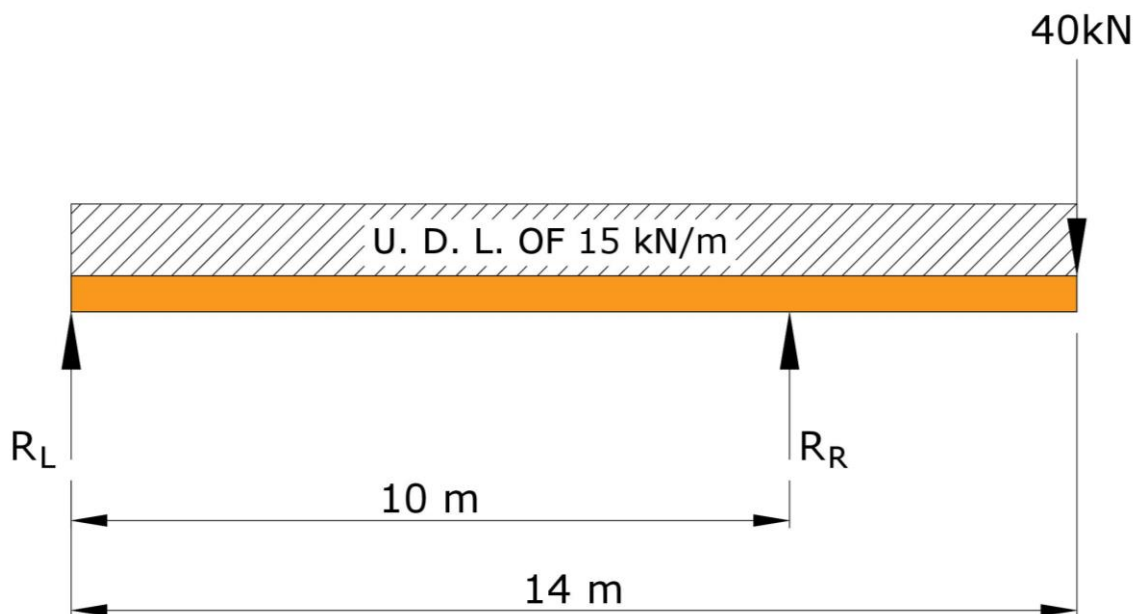


Figure 8

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SUBJECT:	<b>Graphical Communication</b>
PAPER NUMBER:	II
DATE:	5 <sup>th</sup> October 2021
TIME:	4:00 p.m. to 7:05 p.m.

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### Directions to Candidates

Write your index number where indicated at the top of all drawing sheets.

Attempt question 1 and any other **THREE** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

- drawings should conform to B.S. or equivalent (ISO) standards;
- all dimensions are in millimetres;
- answers are to be accurately drawn with instruments;
- all construction lines must be left on each solution;
- drawing aids may be used.

Dimensions not given should be estimated.

Careful layout and presentation are important.

Marks will be awarded for accuracy, clarity, and appropriateness of constructions.

Colour/shading should be used where appropriate.

Mark allocations are shown in brackets.

Question 1 carries 34 marks. Questions 2, 3, 4 and 5 carry 22 marks **each**.

Question 1.

Figure 1 shows three orthographic views of a sitting room, with a staircase leading to the upper floor. These orthographic views detail the proportions of each item of furniture and how these are configured within the given space. Use this information to draw a two-point estimated perspective drawing of the entire setting. The viewing direction is indicated by the arrows on the plan.

- a. Using **THREE** preliminary sketches, explore alternative positions of the horizon line and identify the one which, in your opinion, best describes the spaciousness of the entire area. (3)
- b. Based on the choice made in part (a), use a suitable scale to produce the required illustration on a single side of an A2 size paper, making the best use of the space available. (26)
- c. Enhance your drawing by colouring small areas of the different items appearing in your illustration and as listed in the notes hereunder. (5)

Notes:

- The ceiling has been removed from the plan to reveal the contents of the sitting room.
- The staircase is made from solid pine (light brown wood).
- The shelving beneath the staircase is also made from solid pine.
- The grandfather clock is made from mahogany (dark brown wood).
- The sofa is covered in faux leather fabric (red).
- The carpet is made from a mixture of nylon and polyester (green).
- All other items are left to your discretion.

**(Total: 34 marks)**

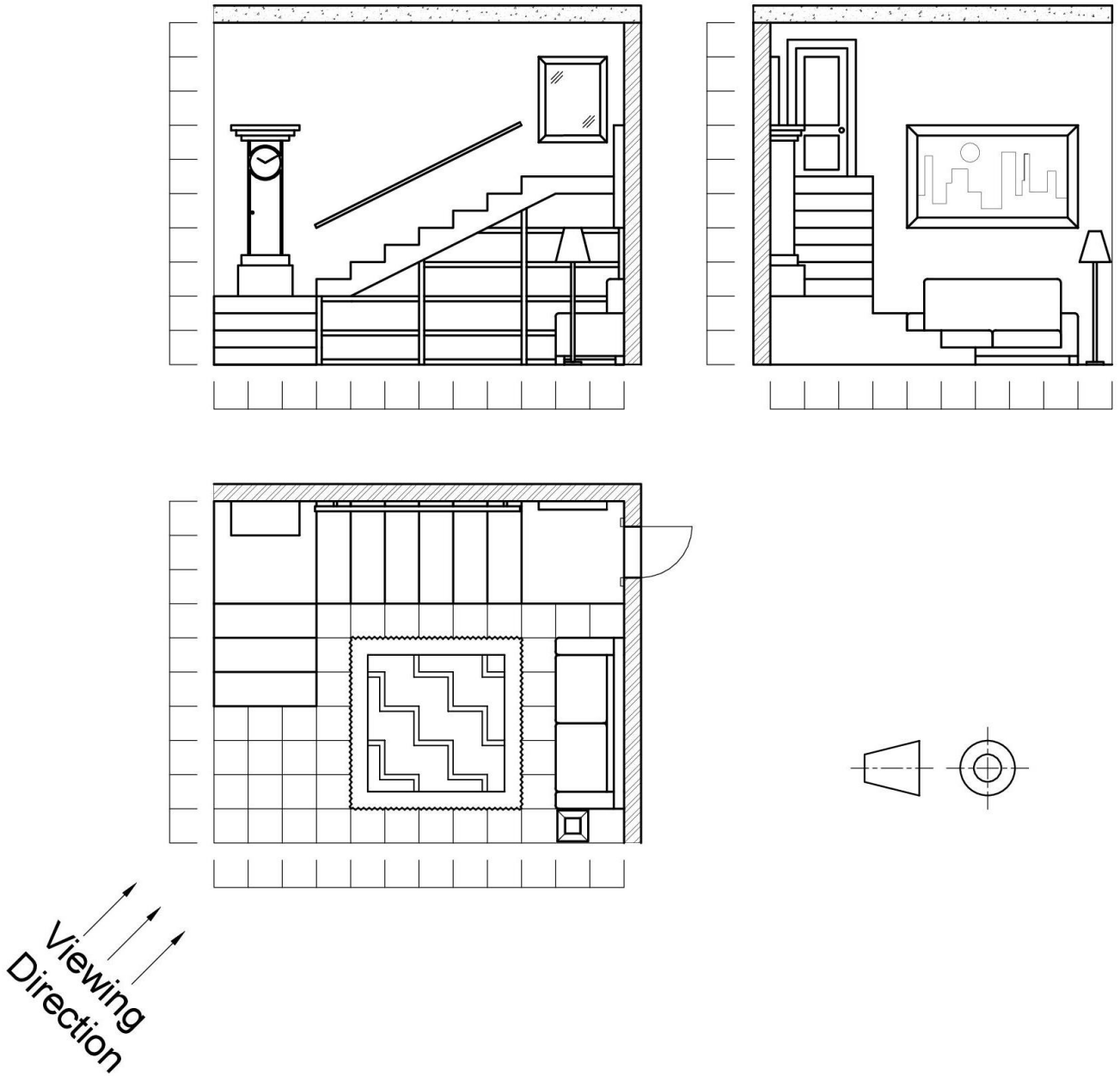


Figure 1

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Question 3.

A local council in Malta conducted a study on the preferred means of transport by the local community, when conducting errands in the same village.

The following data was collected:

	<b>Preferred means of transport by percentage</b>			
<b>Age Category</b>	<b>On foot</b>	<b>Bicycle</b>	<b>Car</b>	<b>Electric scooter</b>
15 - 20	65%	10%	0%	25%
21 - 40	70%	10%	15%	5%
41 - 60	45%	5%	45%	5%
61+	20%	10%	70%	0%

You are required to design an infographic chart for this local council. This chart should represent, through graphical means, the information supplied in the table above. The chart should contain text, graphs, and symbols. The title of this chart should be 'PREFERRED MEANS OF TRANSPORT'.

Suitable typefaces should be used to show all written information. Graphic symbols should complement this information.

Preparatory sketches should be made to help you develop your ideas. It is advisable to divide the space of your A2 sheet as shown in Figure 3.

**(Total: 22 marks)**



***Please turn the page.***

Figure 3

Question 4.

A new music pop band by the name of 'Imperial Flowers' are launching their new album. You have been commissioned to design the cover of their CD album, which bears the name of the band. You need to breakdown your work according to the following steps and present it as shown in Figure 4.

- a. Written analysis  
Identify, using keywords/short phrases the main parameters of the design brief. (2)
- b. Graphical analysis  
Based on your response to the written analysis, produce a series of preparatory sketches that illustrate your developing idea. (4)
- c. Design synthesis  
Clearly identify those elements produced in your sketches that you intend to use in your final design. (2)
- d. Final realisation  
Use colour and shading to produce your final realisation in a square as shown in Figure 4. (14)

**(Total: 22 marks)**

The figure shows a design brief template for 'Imperial Flowers' music band. It is divided into several sections:

- Written analysis:** A section with the title 'Written analysis' and five horizontal lines for notes.
- Graphical analysis:** A section with the title 'Graphical analysis' and a 2x2 grid for sketches.
- Design synthesis:** A section with the title 'Design synthesis' and five horizontal lines for notes.
- Final realisation:** A large square area on the right, labeled 'Final realisation', with dimensions of 280x280 indicated by red arrows and text.

Figure 4

Question 5.

Figure 5a shows a sketched end elevation of a claw hammer, which has been rendered in a manner to appear three-dimensional.

Figure 5b, on the other hand, shows a three-dimensional line sketch of a hair dryer.

You are requested to:

- a. draw a two-dimensional sketch of the hair dryer as seen from the direction indicated by the arrow (end elevation); (12)
- b. apply colour and shading to your sketch to express the volume of the hair dryer. (10)

Notes:

Choose an appropriate light direction to make the volume and the shape transitions of the dryer more recognizable.

**(Total: 22 marks)**

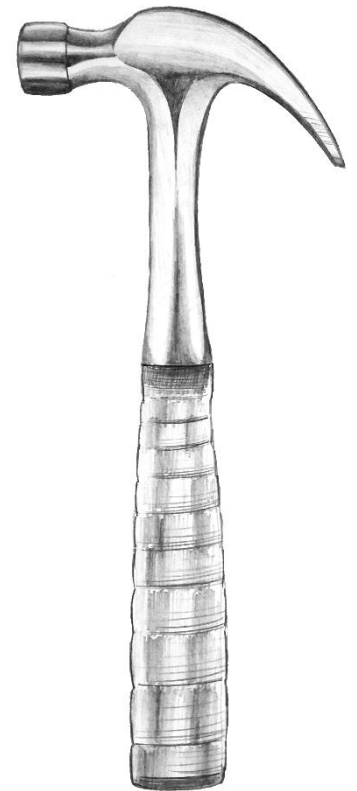


Figure 5a

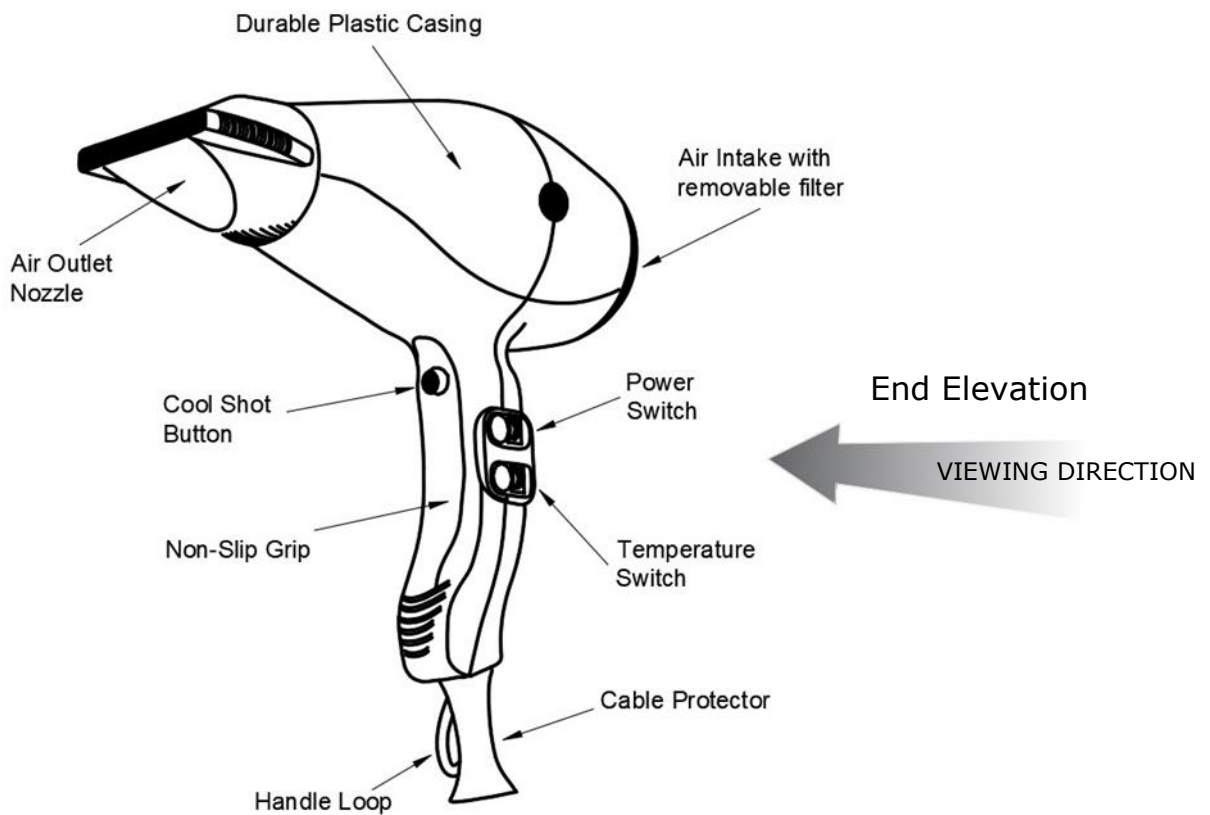


Figure 5b

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